



# **HeatStep<sup>TM</sup>** **Mat**



## **INSTALLATION MANUAL**

**(800) 7Bostik / (800) 726-7845**

Please be aware that local codes may require this product and/or the control to be installed or connected by an electrician. Please leave this manual with the end user.

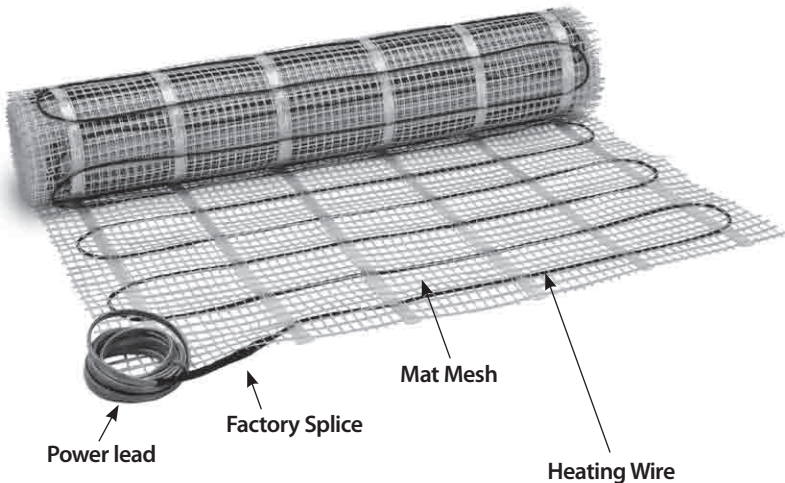
You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product. FAILURE TO COMPLY WITH PROPER INSTALLATION AND MAINTENANCE INSTRUCTIONS COULD RESULT IN PROPERTY DAMAGE, PERSONAL INJURY AND/OR DEATH. Bostik is not responsible for damages resulting from improper installation and/or maintenance.

Welcome to HeatStep™!

HeatStep™ floor heating mats are a simple way to heat an indoor space. This instruction manual is provided as a guide to installing HeatStep™ Mats, including design considerations, installation steps, limitations, precautions, and floor covering guidelines.

Specifications for HeatStep™ Mat:

HeatStep™ Mat is a complete heating mat consisting of a series heating wire and a power lead for connection to the electric power supply. **The heating wire length cannot be cut to fit.**



**Controls:** HeatStep™ Mats must be controlled by a HeatStep™ floor sensing thermostat.

**Voltage:** 120 VAC, 240 VAC, 1-phase (see Table 2)

**Watts:** 12 W/sqft (41 Btu/h/sqft)

**Maximum circuit load:** 15 A

**Maximum circuit overload protection:** 20 A breaker

**GFCI:** (Ground Fault Circuit Interrupter) required for each circuit (included in the HeatStep™ control)

**Listing:** UL Listed for U.S. and Canada under UL 1693 and CAN/CSA C22.2 No. 130.2-93, File No. E185866

**Application:** Indoor floor heating only (-X on the nameplate label indicates CUL Listing for this application). Suitable for installation in a shower area (see Step 4.10 for restrictions). (-W on the nameplate label indicates CUL Listing for Wet Location in Canada per Canadian Electrical Code, Part I (CEC). Embedded in polymer-modified cement based mortar only (see Phase 5).

**Minimum bend radius:** 1 inch

**Maximum exposure temperature:** (Continuous and storage) 194°F (90°C)

**Minimum installation temperature:** 50°F (10°C)

Skill Level

Installation must be performed by qualified persons, in accordance with local codes, ANSI/NFPA 70 (NEC Article 424) and CEC Part 1 Section 62 where applicable.

Prior to installation please consult the local codes in order to understand what is acceptable. To the extent this information is not consistent with local codes, the local codes should be followed. However, electrical wiring is required from a circuit breaker or other electrical circuit to the control. It is recommended that an electrician perform these installation steps. Please be aware local codes may require this product and/or the control to be installed by an electrician.

Expected floor temperature

Heating performance is never guaranteed. HeatStep™ Mat is designed to deliver 12 W/sq.ft. The floor temperature attainable is dependent on how well the floor is insulated, the temperature of the floor before start up, and the overall thermal drain of the floor mass. Insulation is required for best performance. Refer to Phase 5 for important design considerations.

These are the three most common installations:

**1. Wood framing:** With the mat installed on a well-insulated wood subfloor, and thin-set mortar and tile on top, most floors can be heated up to 20°F warmer than they would otherwise be.

**2. Insulated concrete slab:** With the mat installed on an insulated concrete slab, and thin-set mortar and tile on top, most floors can be heated up to perhaps 15°F warmer than they would otherwise be.

**3. Uninsulated concrete slab:** With the mat installed on an uninsulated concrete slab, and thin-set mortar and tile on top, most floors can be heated up to perhaps 10°–15°F warmer than they would otherwise be.

Please consult a designer or the factory if questions remain about the surface temperature that can be expected from the cables in any particular construction.

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Table 1

# CAUTIONS!

## READ BEFORE INSTALLING HEATSTEP™ MAT

As with any electrical product, care should be taken to guard against the potential risk of fire, electric shock, and injury to persons. The following cautions must be observed:

**NEVER** install HeatStep™ Mat under carpet, wood, vinyl, or other non-masonry flooring without embedding it in Bostik SL-150™, WebCrete® 95, WebCrete® 98 or Ultra Finish™.

**NEVER** install HeatStep™ Mat in adhesives or glues intended for vinyl tile or other laminate flooring, or in pre-mix mortars. It must be embedded in polymer-modified, cement based mortar.

**NEVER** cut the heating wire. Doing so will cause dangerous overheating and will void the warranty. The power lead may be cut shorter if necessary, but never remove completely from the heating wire.

**NEVER** bang a trowel or other tool on the heating wire. Be careful not to nick, cut, or pinch the wire causing it to be damaged.

**NEVER** use nails, staples, or similar to fasten the heating wire to the floor.

**NEVER** attempt to repair a damaged heating wire, splice, or power lead using unauthorized parts. Use only factory authorized repair parts and methods.

**NEVER** splice one mat heating wire to another mat heating wire to make a longer mat. Multiple mat power leads must be connected in parallel in a junction box or to the thermostat.

**NEVER** install one mat on top of another or overlap the heating wire on itself. This will cause dangerous overheating.

**NEVER** forget to install the floor sensor included with the thermostat.

**NEVER** install HeatStep™ Mat in any walls, or over walls or partitions that extend to the ceiling.

**NEVER** install mats under cabinets or other built-ins having no floor clearance, or in small closets. Excessive heat will build up in these confined spaces, and the mat can be damaged by fasteners (nails, screws, etc.) used to install built-ins.

**NEVER** remove the nameplate label from the power leads. Make sure it is viewable for inspection later.

**NEVER** extend the heating wire beyond the room or area in which it originates.

**NEVER** allow a power lead or sensor wire to cross over or under a heating cable. Damage could result.

**ALWAYS** completely embed the heating wire and factory splices in Bostik SL-150™, WebCrete® 95, WebCrete® 98 or Ultra Finish™.

**ALWAYS** maintain a minimum of 2" spacing between heating wires.

**ALWAYS** pay close attention to voltage and amperage requirements of the breaker, the thermostat, and the HeatStep™ Mat. For instance, do not supply 240 VAC power to 120 VAC mat as damage will result.

**ALWAYS** make sure all electrical work is done by qualified persons in accordance with local building and electrical codes, Section 62 of the Canadian Electrical Code (CEC) Part I, and the National Electrical Code (NEC), especially Article 424.

**ALWAYS** use copper only as supply conductors to the thermostat. **Do not use aluminum.**

**ALWAYS** seek help if a problem arises. If ever in doubt about the correct installation procedure to follow, or if the product appears to be damaged, the factory must be called before proceeding with the installation.

Installation must be performed by qualified personnel, in accordance with local codes and standards. A licensed electrician is recommended. Read these important warnings and all installation instructions prior to installation. Failure to do so can result in fire, shock, property damage, personal injury, and/or death.



# Phase 1: Designing the System

HeatStep™ Mat should be installed in all interior floor areas intending to be warmed. It cannot be used for exterior applications, snow melting, in or on walls, or in ceilings. In many applications it can be used to heat the room but an accurate heat-loss calculation must be made to determine if enough heat will be provided to match the heat loss.

## STEP 1.1

Make a sketch of the room and measure the overall room size. Measurement should be made from wall-to-wall and include size and location of cabinets, tub, toilets, etc. Determine the total square footage of floor area to be warmed by subtracting out the area associated with the built-ins. Keep in mind the following:

- Heat will not radiate beyond about 1-1/2" on either side of the heating wire, therefore consistent coverage is important.
- Do** install heating wire within about 1-1/2" to 2" from a counter or vanity in the kick-space to ensure warmth in this area.
- Do not** install the heating wire underneath cabinets or fixtures having no floor clearance or inside a wall. Excessive heat will build up and cause damage.
- Do not** run the heating wire into small closets or other confined areas where excessive heat will build up.
- Do not** install the heating wires closer than 6" from toilet rings to avoid possible melting of wax rings.
- Do not** directly cross expansion joints.
- Do not** place the heating wire any closer than 4" from other items such as forced air ducting or potable piping to avoid overheating them.
- HeatStep™ Mat must be laid in a manner to prevent surface obstructions being placed directly over the mat location. Failure to do so will result in capturing heat and may allow potential damage from mounting brackets, bolts, or similar penetrations associated with pedestals, support columns, walls, or similar.
- Install the heating wires 4" to 6" away from the perimeter walls of the room. Make sure the heating wire will not be located underneath finish trim.

- The heating wire and factory splices must be completely embedded in the thin-set. Only the power lead may exit the thin-set and enter the wall. Pull power leads through UL Listed conduit to a UL Listed junction box or the control box.

## STEP 1.2

Multiply the heated area square footage calculated in Step 1.1 by 0.90 to allow 4" to 6" spacing around the edges of the floor area. Use this resulting square footage to select the appropriate mats from Table 2 on page 5.

### Remember:

- Do not** exceed 15 amps at 120 VAC (1800 watts) or 15 amps (3600 watts) at 240 VAC through a single HeatStep™ control or HeatStep™ Relay.
- Select either 120 VAC or 240 VAC depending on the power available. **DO NOT** mix voltages on the same HeatStep™ control if more than one mat is to be installed to cover an area.
- Load no more than 12 amps on a 15-amp circuit breaker, or 15 amps on a 20-amp circuit breaker.
- If the area requires more than 15 amps to be controlled by one thermostat use HeatStep™ Relays to take the additional amp load.
- See the Wiring Diagrams in Appendix for further information.

If the exact size of product calculated is not found in the selection Table 2 on page 5, it may be necessary to adjust the warming area(s) or select the next smaller size. **Remember, the heating wire must never be cut shorter to fit, and must be completely embedded in thin-set, thick-set, or self-leveling mortar. Failure to do so may result in damage to the product. Do not select a product larger than necessary.**

Kitchen Design

Refrigerator

Sink

Cabinets

1. Heated area = total area – built-in areas.

2. Multiply heated area x 0.90

3. Select Appropriate product size



**STEP 1.3**

Make sure proper subfloor materials are selected in accordance with the construction and floor covering requirements. Use of a moisture barrier, an anti-fracture membrane, backerboard, or other materials are recommended when installing tile or other stone floor covering.

**STEP 1.4**

Pay careful attention to the total amps when selecting multiple mats to make sure the controls, circuit breaker panel, and all wiring have the proper capacity. Design circuit protection and wiring to handle 125% of total amp load.

## Phase 2: Preparations

Before installing HeatStep™ Mat, make sure to fully inspect the products and carefully plan the site.

### Items Needed

**Materials:**

- HeatStep™ thermostat control with floor sensor. The HeatStep™ control is listed separately from the HeatStep™ Mat.
- 20-amp circuit breaker
- UL Listed electrical box (extra deep) for the control; single-gang (not a gangable type) for one or two mats or 4"-square deep box with a single-gang "mud ring" cover
- 4" junction box with a cover (if needed)
- Flexible or rigid UL Listed conduit (for new construction)
- 12-gauge or 14-gauge electrical wiring cable (consult local code)
- Wire nuts if using an additional junction box
- Nail plate

**Tools:**

- Digital multi-meter for ohms testing; must read up to 20,000 ohms to measure sensor
- Drill with 1/2" & 3/4" bits
- Hammer and chisel
- Wire strippers
- Phillips screwdriver
- Fish tape
- Hole saw
- Floor covering installation tools

**Table 2** (HeatStep™ Mat sizes)

120 VAC					
2 ft Wide	Mat Square Footage	Mat Size (W x L)	Model Number	Amp Draw	Ohms
	30	2' x 15'	K640115	3.0	34 - 42
	40	2' x 20'	K640120	4.0	25 - 32
	50	2' x 25'	K640125	5.0	20 - 26
	60	2' x 30'	K640130	6.0	17 - 21
	70	2' x 35'	K640135	7.0	14 - 18

Note: Other HeatStep™ Mat sizes available in both 120 VAC and 240 VAC upon request.

*It is important to select the proper sized HeatStep™ Mat for the given area. HeatStep™ Mat can not be cut shorter in order to fit a given area. Doing so will damage the heating wire and will prevent the system from working.*

## INSPECT MAT, CONTROL, and SENSOR



**CAUTION:** Make sure power is not applied to the product until it is fully installed and ready for final testing. All work must be done with power turned off to the circuit being worked on.

### STEP 2.1

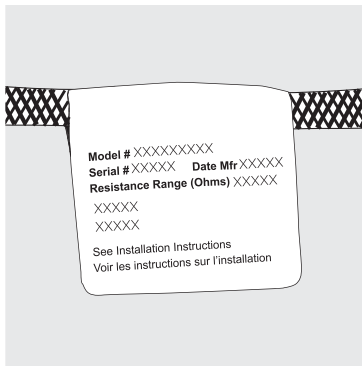
Remove the Mat, HeatStep™ control, and HeatStep™ sensor from their packages. Inspect them for any visible damage and verify everything is the correct size and type according to the plan and the order. Do not attempt to install a damaged product.

### STEP 2.2

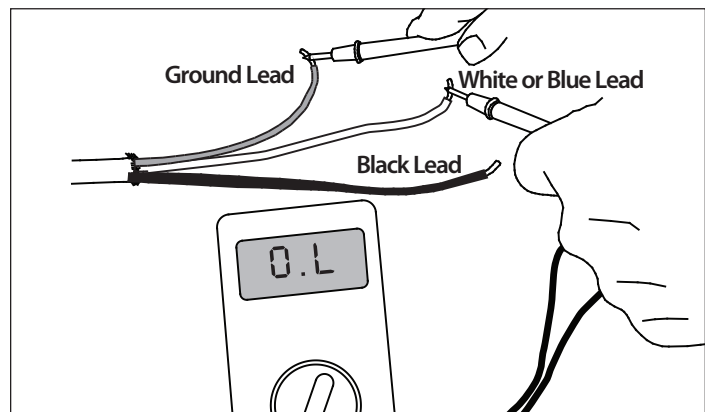
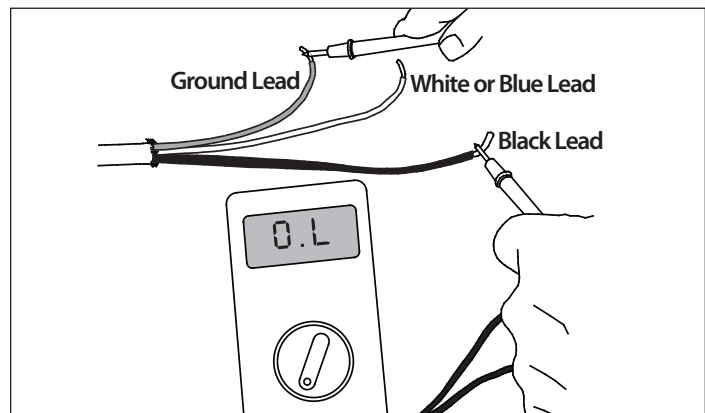
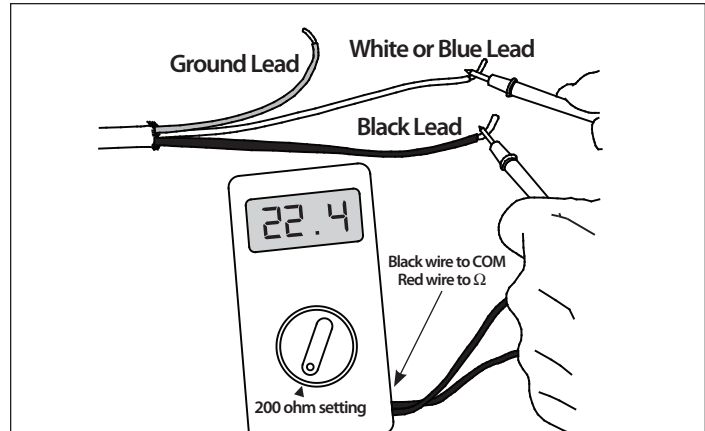
Record the product information in **Table 4**. Give this information to the homeowner to keep in a safe place.

The HeatStep™ Mat model number, serial number, voltage, and resistance range are shown on a nameplate label attached to the power leads, as well as the marking "(x)-FOR INDOOR FLOOR HEATING APPLICATIONS".

**Do not remove this nameplate label. The electrical inspector will need to see this.**



*Record the information from the nameplate label into the HeatStep™ Mat and Sensor Resistance Log. Leave the nameplate label attached to the power leads for later inspection.*



*Press the test lead tips to the Black and White (or Blue for 240 VAC) power lead wires. This reading should correspond to the factory resistance range on the nameplate label attached to the Power lead.*

*Readings between the Black and Ground and the White (or Blue for 240 VAC) and Ground power lead wires should measure "open", or "0.L", or the same as displayed when the test leads are not touching anything.*

### STEP 2.3

Use a digital multi-meter set to the 200Ω or 2000Ω (2kΩ) range to measure the resistance between the conductors of the mat power leads. Record these resistances in **Table 4** under "Out of the box before installation".

The resistance should measure within the resistance range on the nameplate label. If it is a little low, it may be due to low air temperatures or meter calibration. Consult the factory if in doubt.

Measure the resistance between either of the white or black leads and ground lead. This measurement should be “open”, usually indicated by an “OL” or a “1”. This is the same as displayed when the test leads are not touching anything.

If there is any change in the reading, record this information and contact the factory before continuing. This could indicate damage, test lead problems, or a number of other issues. Try “pinning” the test leads to the cable lead wires against a hard non-metal surface if the readings continue to fluctuate.

Change the meter to the 20,000 ohms (20 kΩ) range. Measure between the lead wires of the HeatStep™ sensor. This resistance varies according to the temperature sensed. **Table 3** provides approximate resistance-to-temperature values for reference.

**Table 3** (floor sensor resistance values)

Temperature	Typical Values
55°F (13°C)	17,000 ohms
65°F (18°C)	13,000 ohms
75°F (24°C)	10,000 ohms
85°F (29°C)	8,000 ohms



*The Wire Fault Detector will constantly monitor the heating wire during the entire installation process. If the wire is cut or damaged during installation, the Wire Fault Detector will sound an audible alarm.*

**Table 4 - HeatStep™ Mat Resistance Log**

	Mat 1	Mat 2	Mat 3
Mat serial number			
Mat model number			
Mat voltage			
Mat resistance range			
Sensor			
<b>OUT OF THE BOX BEFORE INSTALLATION</b>			
Mat white to black			
Mat white to ground			
Mat black to ground			
Sensor			
<b>AFTER MAT IS SECURED IN PLACE</b>			
Mat white to black			
Mat white to ground			
Mat black to ground			
Sensor			
<b>AFTER FLOOR COVERINGS ARE INSTALLED</b>			
Mat white to black			
Mat white to ground			
Mat black to ground			
Sensor			
<b>Retain this log to retain the warranty! Do not discard!</b>			



# Phase 3: Electrical Rough-in

## STEP 3.1: Circuit Breaker (Overcurrent Protection)

HeatStep™ Mat(s) must be protected against overload by a circuit breaker. GFCI type (ground fault circuit interrupter) or AFCI type (arc-fault circuit interrupter) breakers may be used if desired, but are not necessary.

The rating of the breaker (see Table 5) is determined by the amp draw of the heating mats (see Table 2 or the Nameplate Label). If multiple mats are to be controlled by one HeatStep™ control, total their amp draws. If this total exceeds 15 amps, an additional breaker and control will be required. The total amps on each breaker can not exceed 15 amps. Do not use breakers rated over 20 amps.

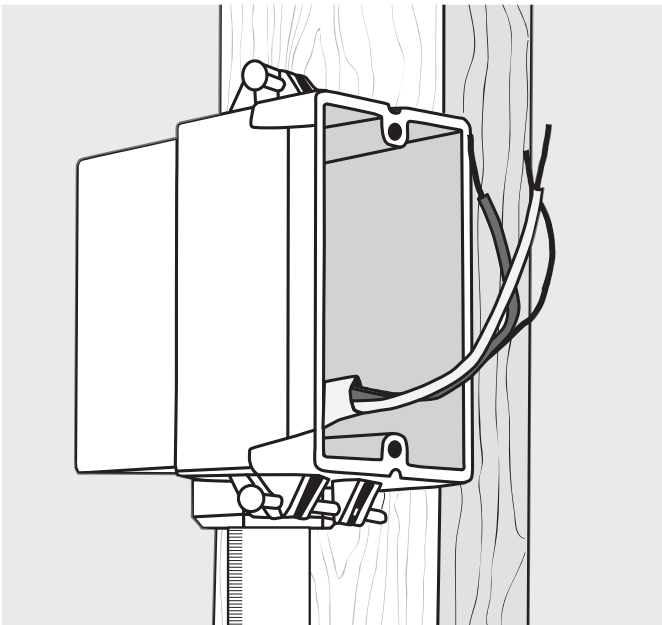
Table 5

Circuit Breakers and Supply Wire					
Mat(s)		Supply Wire		Breaker	
VAC	total amps	(AWG)*	qty	type**	rating
120	up to 12 amps	14	1	SP	15 or 20 A
120	up to 15 amps	12	1	SP	20 A
240	up to 12 amps	14	1	DP	15 or 20 A
240	up to 15 amps	12	1	DP	20 A

\* Recommended only. Follow local codes for wire gauge size.

\*\* SP= single-pole, DP=double-pole

It may be possible to tap into an existing circuit as long as there is adequate capacity for the mat(s) and any additional appliance, such as a hair dryer or vacuum cleaner. Avoid circuits which have lighting, motors, exhaust fans, or hot tub pumps due to possible interference.



## STEP 3.2: Install Electrical Boxes

### HeatStep™ Thermostat:

Install an extra-deep electrical box for the HeatStep™ thermostat. Follow the instructions included with the HeatStep™ control for complete information on location and wiring.

### HeatStep™ Relay:

Install an extra-deep electrical box for any HeatStep™ Relay(s). The HeatStep™ Relay is used when more than 15 amps must be controlled by one HeatStep™ thermostat. Follow the instructions included with the HeatStep™ Relay for complete information on location and wiring.

### Junction Boxes:

If a mat is to be located so its Power lead is not long enough to reach the HeatStep™ control or HeatStep™ Relay directly, a junction box must be installed. Do not attempt to make a connection to other wiring without a junction box. Use a standard junction box with a cover, mounting it below the subfloor, in the attic, in the wall, or in another location easily accessible after all coverings are complete. If the HeatStep™ control sensor wire is not long enough to reach the HeatStep™ control directly, it may be extended. A junction box may be required by local code to make this connection. Follow the installation instructions included with the HeatStep™ control for details.

For construction with an existing wall or where the wall is covered, cut the necessary openings to mount the electrical boxes listed above. Wait to install the boxes until all wiring is fed into these locations to make it easier to pull the wire.

⚠ WARNING

*To prevent the risk of personal injury and/or death, do not perform any electrical work unless qualified to do so. Work should be done with great care and with power turned off to the circuit being worked on. Follow all local building and electrical codes.*

Install an extra-deep single-gang box if connecting one or two cables to the control. Use a 4"-square deep box with a single-gang mud ring cover if connecting three cables, because the extra room is needed for the wire, wire nuts, and control.

### STEP 3.3: Bottom Plate Work

Drill or chisel holes at the bottom plate as indicated. One hole is for routing the power lead conduit and the other is for the thermostat sensor. These holes should be directly below the electrical box(es).

### STEP 3.4: Install Power Lead Conduit and Thermostat Sensor

#### Power Lead Conduit:

The shielded power lead can be installed with or without electrical conduit (recommended for added protection against nails or screws) depending on code requirements. Remove one of the knock-outs in the electrical box to route the power lead. If electrical conduit is not required by code, install a wire collar to secure the power leads where they enter the box. If conduit is required by code, install 1/2" (minimum) conduit from the bottom plate up to the electrical box. For multiple power leads (multiple mats) install 3/4" conduit.

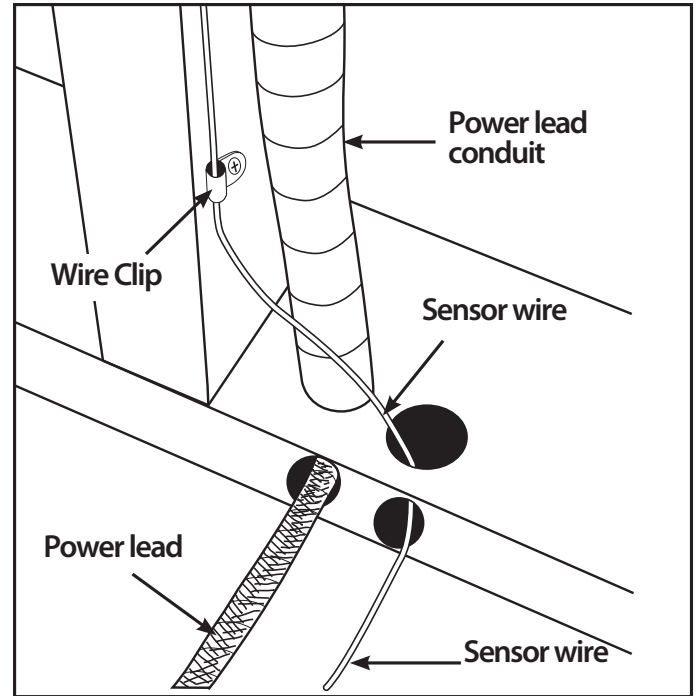
#### Thermostat Sensor:

The HeatStep™ control sensor can be installed with or without electrical conduit depending on code requirements. Conduit is recommended for added protection against nails or screws. Do not place the sensor in the same conduit as the power leads to avoid possible interference. Open a separate knock-out in the bottom of the thermostat box. Feed the sensor (and conduit, if used) through the knock-out, down through the cut-out in the bottom plate, and out into the floor where the heating mat will be installed. If the sensor wire needs to be secured to the wall stud, wait until after the mat and sensor are completely installed on the floor.

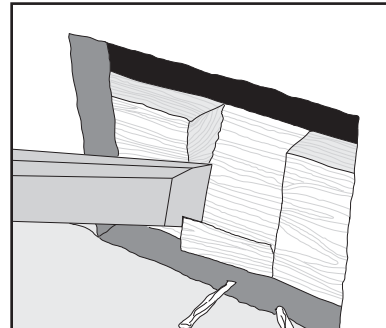
### STEP 3.5: Rough-in Wiring

Install appropriate 12 or 14 AWG electrical wire from the circuit breaker or branch circuit source to the HeatStep™ control electrical box (and HeatStep™ Relay box(es) if needed) following all codes, see Table 5.

If HeatStep™ Relay(s) are used, feed appropriate wire (see HeatStep™ Relay installation manual for size and type) between the HeatStep™ Relay(s) and the HeatStep™ control.



Conduit enclosing power lead.



If going in to an existing wall, cut out dry wall and chisel out bottom plate to route wires to control.

## Phase 4: Mat Installation

### STEP 4.1: Floor Cleaning

The floor must be completely swept of all debris including all nails, dirt, wood, and other construction debris. Make absolutely sure there are no objects on the floor which might damage the Mat wire.

Follow instructions for subfloor prep for Bostik SL-150™, WebCrete® 95, WebCrete® 98 or Ultra Finish™.

### STEP 4.2: Material

Make sure all of the correct materials have been purchased. A general list of materials is found at the beginning of this manual.

Verify the amount of mat supplied is the proper size for the area to be heated before beginning the installation. Verify thermostat location.

### STEP 4.3: Position the Power Leads

Carefully cut the tie binding the power lead coil. Do not nick the braid covering the power lead.

Place the mat on the floor to ensure the power lead will reach the HeatStep™ control electrical box or junction box location.

If the power lead will need to cross a long distance to reach the control location, it may be possible to cut the mat mesh and pull loose the length of heating wire needed.

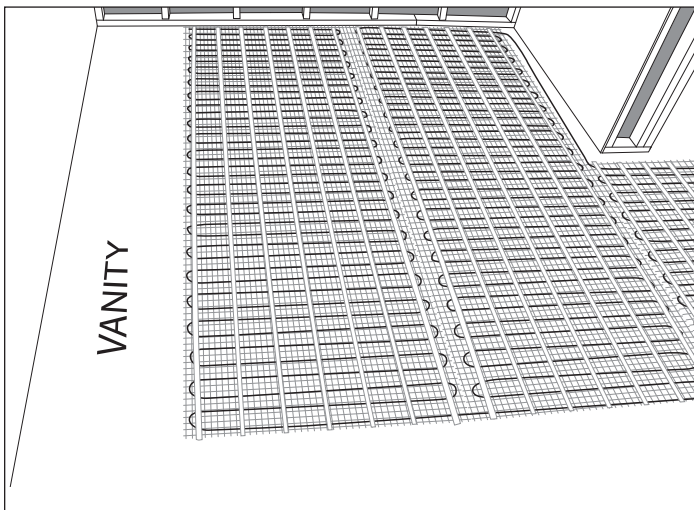
**Make sure the power lead factory splice is to be completely flat and in the floor mortar, not in the wall.**

### STEP 4.4: Test Fit the Mat

Roll out the mat, flipping it as needed to cover the intended area. This is very important to ensure proper fit before proceeding. If there is too much mat for the area it cannot be cut shorter and heating wire cannot be routed into a wall, under baseboards, or other similar areas. All heating wire must be embedded in the floor mortar.



**CAUTION:** Do not cut the heating wire to make it fit the area. Doing so will cause dangerous overheating and will void the warranty.



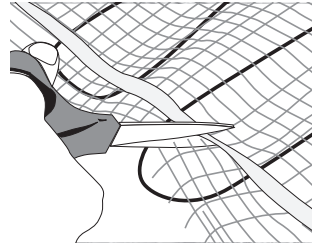
Install the mat approximately 4"–6" away from walls, showers, tubs, drains, etc. and 6" from a toilet wax ring. Install in-line with vanity and counter areas. Install roughly 20" from back wall in toilet area.

**DO NOT** leave gaps between the mats. The heat will conduct only about 1-1/2" from the heating wire. Mat should be installed continuously across the floor. Never install mats in a fashion causing the heating wires to be any closer than 2" from each other or to overlap.

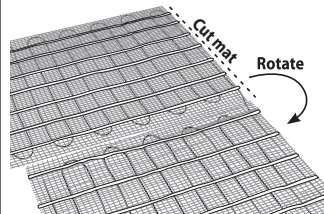
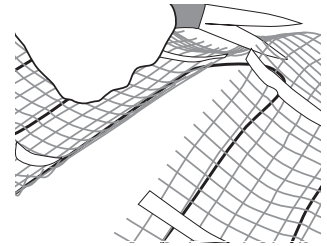
To warm the maximum amount of floor area, it may be necessary to make the mat(s) fit odd-shaped spaces, fit into corners, and work around angles and built-ins. See Table 6 for technique examples and the Appendix for full layouts, additional techniques, and cautions.

**TABLE 6:  
MAT TURNS AND "FILL-IN" TECHNIQUES**

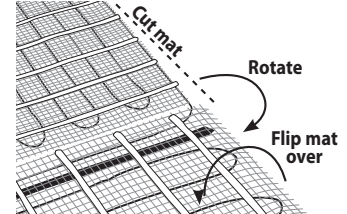
This table contains some of the common turns and techniques used to layout around corners, angles, and built-ins.



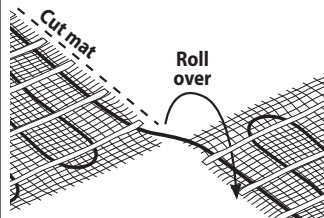
Carefully cut the white mesh to make turns. Never cut, nick, or otherwise damage the heating wire.



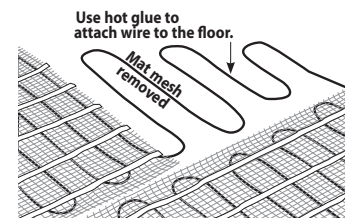
180° or Back-to-Back Turn.



90° or Flip Turn.

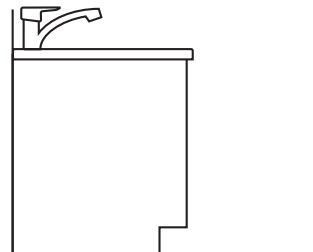


Roll-over Turn.



Fill-in Technique.

#### Installing in front of cabinets and toilets:



Install mat right up to the face of the cabinet as shown above.



Mat can be installed under tile to within 6" from the wax ring, and can slightly underlay the foot of the toilet if need be (approximately 20" from wall).



#### STEP 4.5: Secure the Mat to the Floor

After test-fitting the mat and deciding what technique will be used to help fill any odd spaces, carefully cut the mesh where needed.

Lay the mat down flat. Ensure it fits well and has no folds or large ripples.

**IMPORTANT: Securing the mat as flat as possible will help make a smooth surface for spreading mortar.**

Secure the mat to the flooring using the double-sided tape supplied in the installation kit. Apply a length of the tape to the floor at each end of the mat and every 12" to 24" (30 cm to 60 cm).

If an area of mesh does not lay flat enough, use hot-glue, or pneumatically applied staples to help. This may be necessary at the ends of the mat. If staples are used, 3/8" x 1/4" chisel type are recommended. Do not staple closer than 1/4" (7 mm) from the heating wire. Be very careful not to damage the heating wire.

**DO NOT** staple or apply tape over the heating wire. Damage can result.

**DO NOT** use nails, duct tape, other types of tape, or other unapproved fasteners to hold the heating wire or mesh in place. Damage can result.

#### STEP 4.6

Use a digital multi-meter to measure the resistance between the conductors of the power leads again. Record these resistances in **Table 4** under "After mat is secured in place".

#### STEP 4.7

Connect the Wire Fault Detector to the mat power lead. If multiple mats are used, connect them to the Wire fault detector in series (white-to-black). Only one white, black, and ground lead should be connected to the Wire fault detector. Refer to the Appendix for Wire fault detector wiring diagrams.

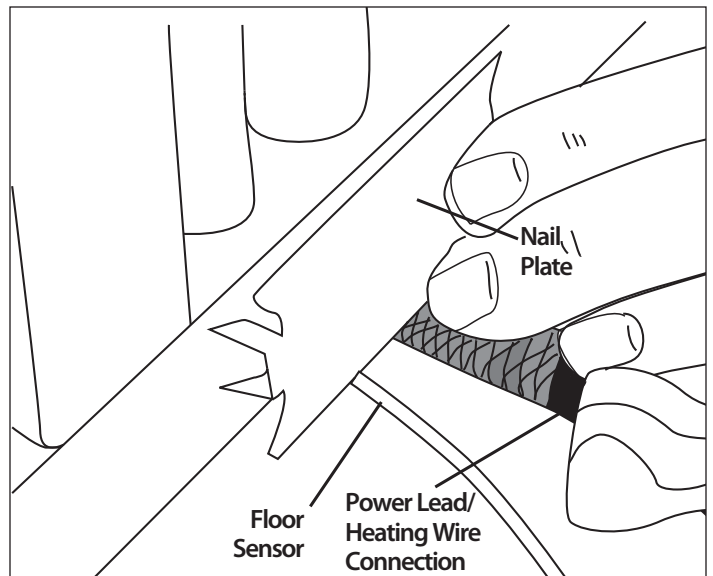
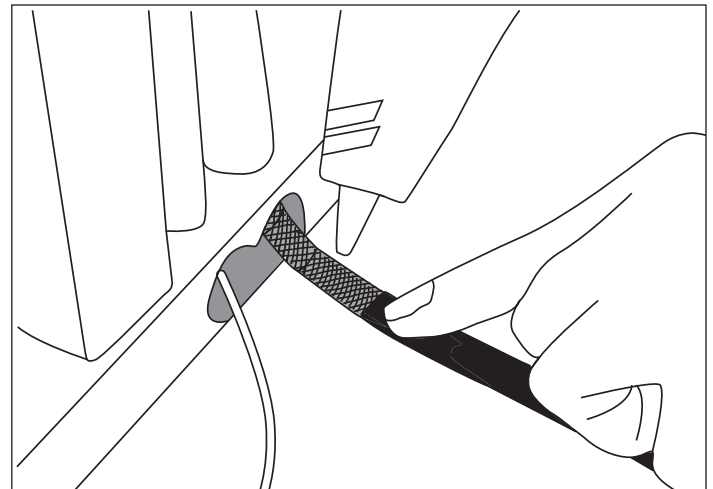
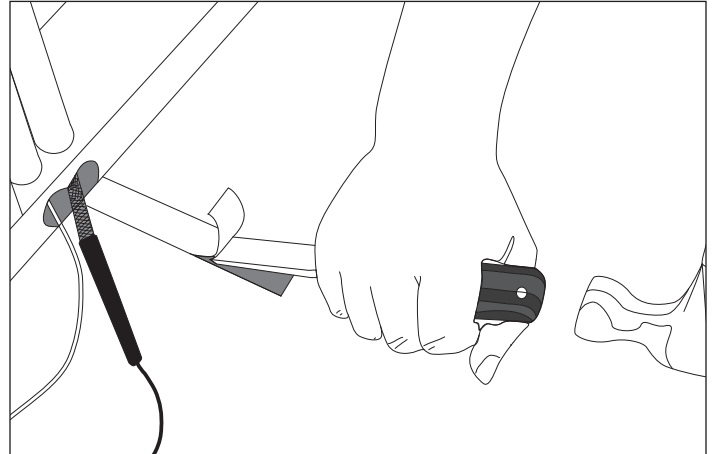
#### STEP 4.8

Feed the power leads through the conduit to the control electrical box, leaving at least 6"-8" of free power lead. Chisel a slot in the floor to recess the factory splice level with the heating wire. Secure the factory splice with hot glue so it cannot be pulled into the conduit.

It may be necessary to use a metal nail plate to protect the power lead and sensor wire as they transition into the wall. This will help prevent nail penetrations from drywall and baseboards trim.

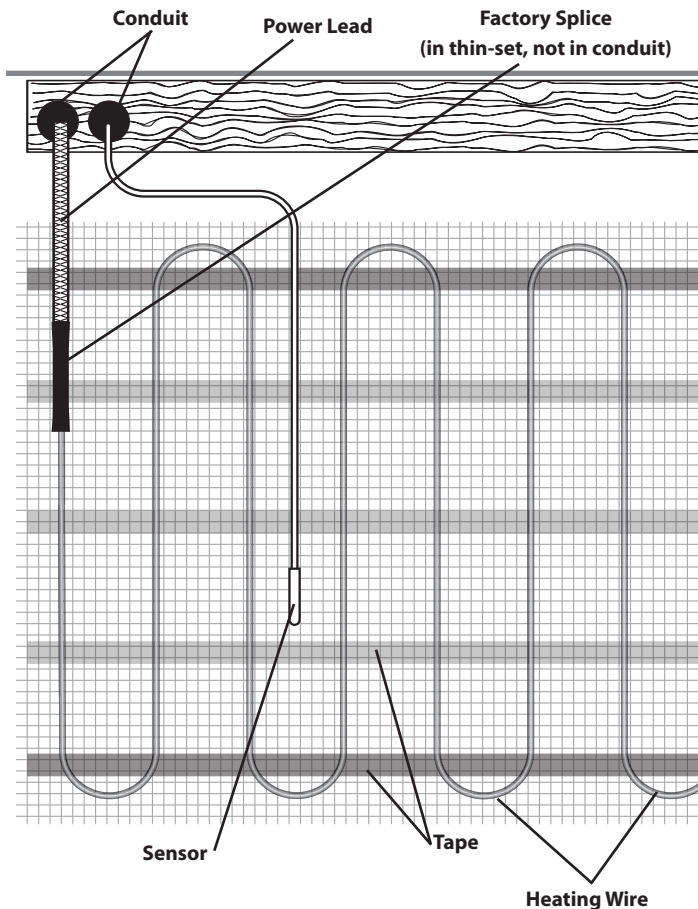
#### STEP 4.9

Feed the sensor wire through the sensor conduit, leaving at least 6"-8" of free lead length at the control electrical box. Weave the sensor at least 1' into the mat area, halfway between the heating wires, and secure it using hot glue. Do

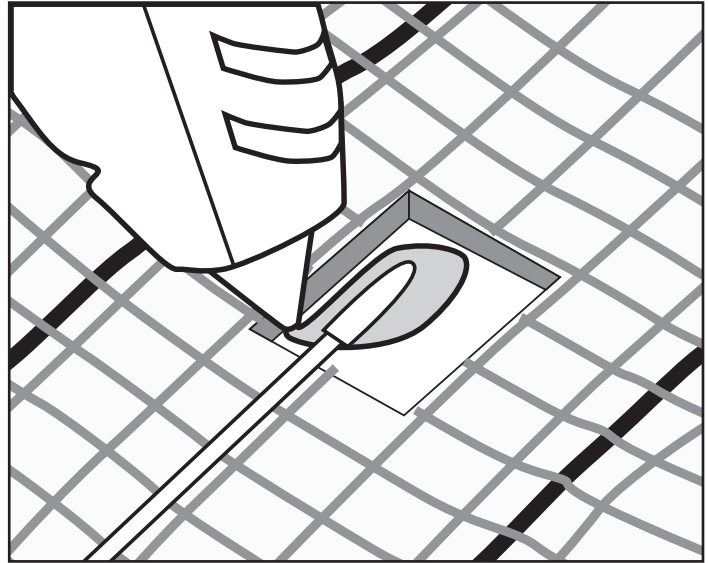


*Chisel a path for the power lead and factory splice. Use hot glue to secure to the floor. Place a metal nail plate over the transition point to protect the power lead and sensor wire.*

not cross the heating wires. It may be necessary to chisel a small section of the subfloor to accommodate the sensor, depending on the thin-set thickness being used.



**Top-Down view of HeatStep™ Mat and the sensor entering wall.**



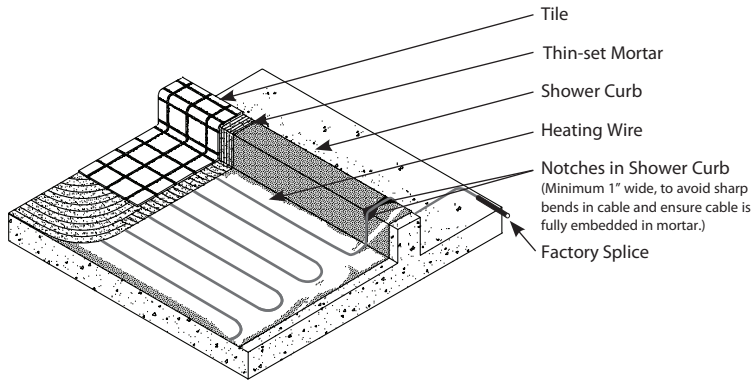
#### **STEP 4.10: Shower Application**

**Note: Acceptance of this application must be verified by the local inspector or authority having jurisdiction (AHJ).**

1. Refer to diagrams in the Appendix, especially page 17.
2. Never install Mat in shower walls (or any other wall).
3. Never make a field splice to mats installed in a shower.
4. Use the double-sided tape or hot-glue to secure the mat. Do not use staples or anything that will damage any waterproofing membrane.
5. Make a 1" wide notch in the curb to embed the heating

wire. Ensure the wire is not pinched or bent sharply. Do not run the heating wire through a non-masonry curb, causing it to overheat.

**Locate power lead and factory connection to heating wire at least 1' outside the shower area.**



6. Embed mats in mortar and install only under tile, stone, brick, or other masonry surface, per this instruction manual.
7. Never begin the mat in a shower. The connection between the power lead and the heating wire must be fully embedded in mortar and located at least 1' (304.8 mm) away from shower openings and other areas normally exposed to water.
8. Mat controls must be located at least 4' away from shower openings. Controls cannot be exposed to water or touched by a person while in the shower area.
9. All grout seams should be sealed after the mortar and grout has completely cured.
10. As an option, consider installing a dedicated mat in the shower area, separate from the rest of the floor. This will increase control options, allowing less floor to be warmed when the shower is not required. It will also allow for better isolation of the shower area in the off-chance a problem occurs.

#### STEP 4.11

**Take photographs of the mat installation. This can be very useful later during remodel work to help avoid possible wire damage. Keep the photos with this installation manual and provide to end user upon completion.**

## Phase 5: Floor Coverings

It is recommended to consult with professional flooring installers to make sure proper materials are used and proper installation techniques are followed. Please note, this installation manual is not a structural or a floor covering installation manual and is intended only for general guidance as it applies to the HeatStep™ Mat product.

When installing tile or stone, the Tile Council of North America (TCNA) guidelines, National Tile Contractors Association (NTCA), or ANSI specifications should be followed as a minimum standard.

Use Bostik SL-150™, WebCrete® 95, WebCrete® 98 or Ultra Finish™. Do not use water-based multi-purpose materials when installing a radiant product.

Do not use solvent based adhesives or pre-mix mortars because they are not as heat resistant and do not conduct heat well.

Select the proper size trowel for the installation of tile or stone. We recommend a minimum 3/8" x 1/4" trowel. This trowel works well for most ceramic tile. A thicker thin-set can be used if required. Select the thin-set thickness in accordance with the floor covering requirements.

For additional information on tile installation, please contact TCNA at 864-646-8453 or visit their web site at [www.tileusa.com](http://www.tileusa.com), or contact NTCA at 601-939-2071 or see their web site at [www.tile-assn.com](http://www.tile-assn.com)

When installing floor coverings other than tile or stone, follow industry and/or manufacturer's recommendations. Ensure the mat is first covered with a layer of SL-150™ self-leveling cement based mortar, letting it cure fully before applying any surface underlayment, floating wood or laminate flooring, carpet, etc. The combined R-values of all floor coverings over the mat should not exceed R-3. Higher R-values will diminish performance. Consult the floor covering manufacturer to verify compatibility with radiant electric heat. Also, make sure nails, screws, or other fasteners do not penetrate the floor in the HeatStep™ Mat area. The wire can easily be damaged by fasteners penetrating the floor.

All floor coverings must be in direct contact with the cement-based mortar encasing the mat. Do not elevate the floor above the mortar mass. Do not install 2" x 4" wooden nailers (sleepers) on top of a slab for the purpose of attaching hardwood. Any air gap between the heating mat and the finished floor covering will drastically reduce the overall output of the heated floor.

Care should be taken when laying area rugs, throw rugs, and other surface products on the floor. Most products are okay to use, but if in doubt, consult the product manufacturer for compatibility. Do not use rubber backed products that may degrade or very heavy rugs that will trap heat. Be careful not to place a rug over the area where the sensor tip was placed, causing false thermostat readings.

When placing furniture make sure an air clearance of at least 1-1/2" is available. Furniture able to trap heat can damage the heating system, the flooring, and the furniture over time.

**Use a digital multi-meter to measure the resistance between the conductors of the power leads again. Record these resistances in Table 4 under "After floor coverings are installed".**



## Type of Construction

### Mortar Applications:

Thin-set and thick-set (self-leveling) mortar applications are illustrated to the right.

- If a backer board or plywood sheeting is used to strengthen the floor, or if the mat will be placed directly onto the slab, install mat in the thin-set mortar bond coat above these materials.
- If a thicker mortar bed, or self-leveling concrete, is used to strengthen the floor, mat can be installed in either the mortar bed (dry-set) or in the mortar bond coat directly below the tile or stone.

HeatStep™ Mat is generally installed above the self-leveling mortar in a thin-set bond coat. Use plastic lath instead of the typical metal lath when installing in a self-leveling layer.

### Self-leveling Mortar Applications:

These are appropriate applications if installing engineered wood, vinyl, laminate, or carpet floor coverings. Attach the mat to the subfloor or slab, then pour self-leveling mortar 3/8" to 1/2" thick. Install floor covering after the mortar has cured.

### Special Precautions

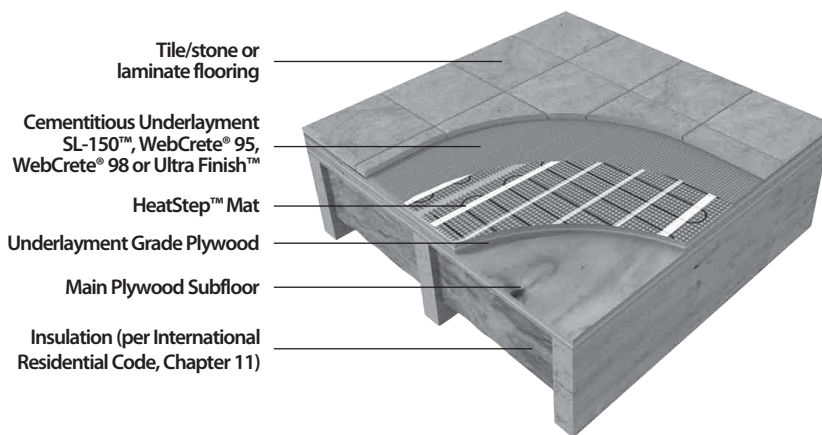
**Isolation Membrane:** Install the mat above the membrane, whenever possible, unless recommended otherwise by the membrane manufacturer.

**Insulation:** Insulation dramatically enhances the performance and efficiency of floor-warming systems. Do not install rigid insulation directly above or below backer board or mortar.

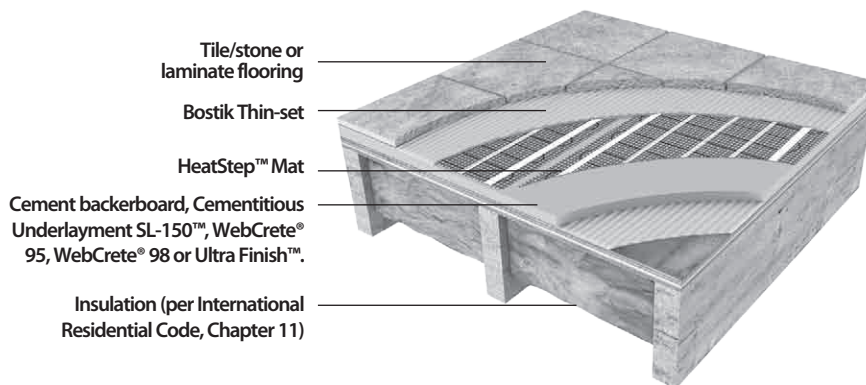
**Mosaic Tile:** When installing mosaic tile, it is recommended to apply a two-step process. First, embed the mat in a thin self-level mortar bed (1/4"–3/8"), then thin-set the mosaic tile according to typical practice.

**Expansion Joints:** Do not install heating mats through an expansion joint. Install mats right up to the joint, if necessary, but not through the joint.

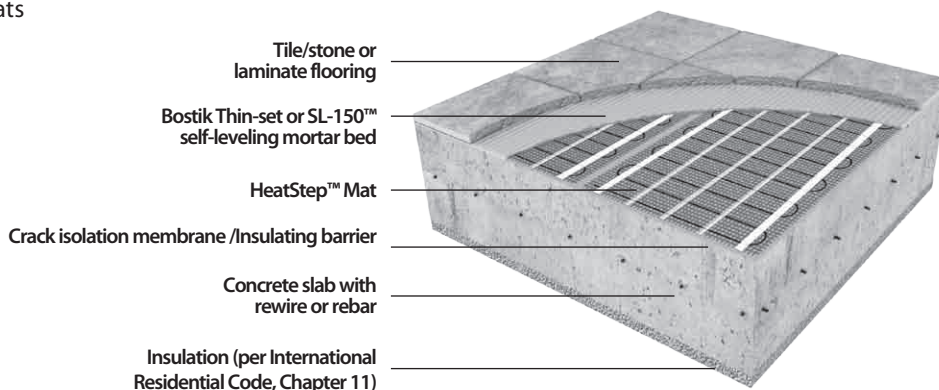
## DOUBLE-PLYWOOD OVER FRAME FLOOR



## CEMENT BACKERBOARD OVER FRAME FLOOR



## THIN-SET OVER SLAB ON GRADE



### CAUTION

**Never bang a trowel on the Heating Wire to remove excess mortar from the trowel. This could damage the heating wire.**

## Phase 6: Control Installation

### Step 6.1: Install the Controls

If it has not already been done, install an electrical box for the HeatStep™ control and HeatStep™ Relay. Do not forget to attach a single-gang mud-ring to mount the HeatStep™ control if a 4" square box was used. See Phase 3 for details.

### Step 6.2

Refer to the wiring diagrams in the Appendix of this manual for typical configurations.

### Step 6.3

Read and follow the instructions included with the HeatStep™ thermostat and HeatStep™ Relay for complete connection instructions, requirements, and mounting.

### Step 6.4

Make any final connections to the circuit breaker or branch circuit source.

### Step 6.5 System Start Up

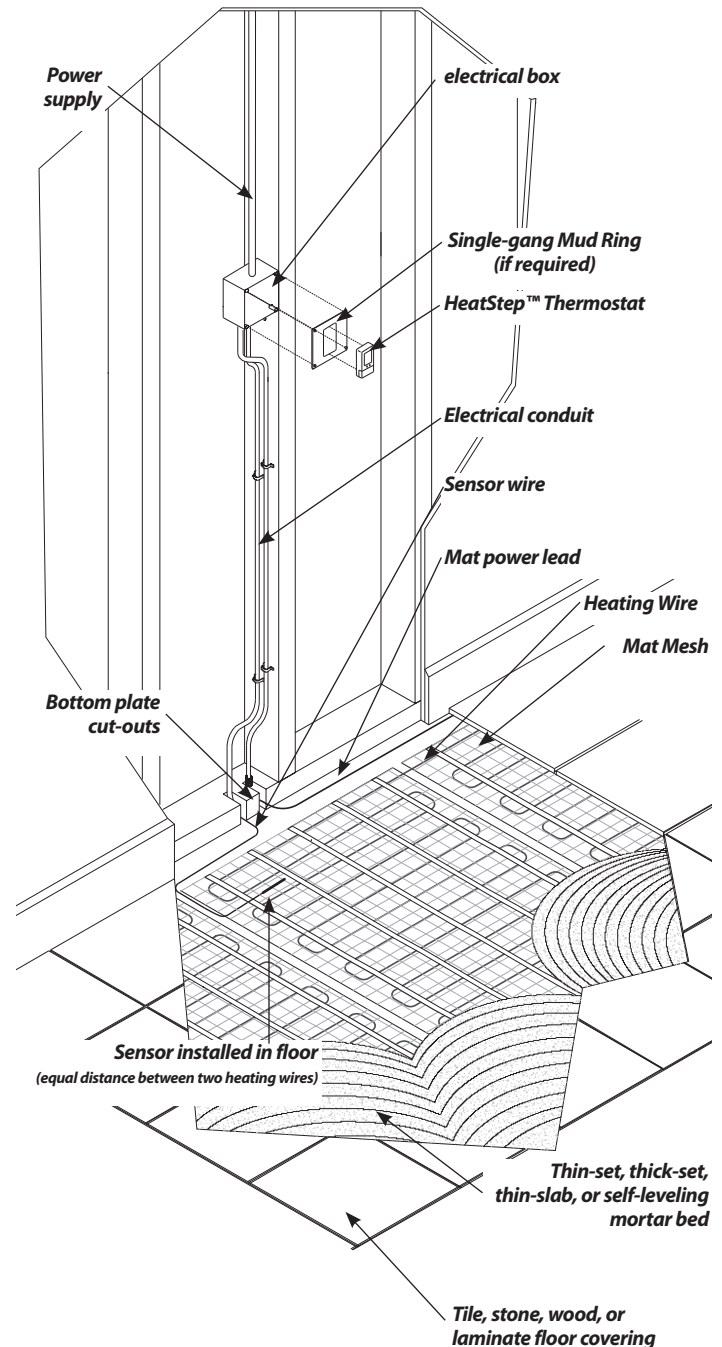
After all controls are installed, do not energize the system, except to briefly test operation of all components (no longer than 10 minutes). **Do not put the system into full operation until the tile or flooring installer verifies all cement materials are fully cured (typically two to four weeks).** See instructions for recommended curing time for the cementitious products used..

**NOTE:** Most laminate and wood floor manufacturers specify their flooring should not be subjected to temperatures over 82° to 84°F (27° to 28°C). Check with the flooring dealer or manufacturer and set the thermostat Floor Limit temperature appropriately.

Refer to the installation sheets provided with the controls for proper setting. The system should now operate as designed. **Please leave this instruction manual, HeatStep™ control instructions, and copies of photos of the installed heating system with the end user.**

Place this warning label (provided with the product) on the electrical panel and indicate the circuit breaker number that supplies the radiant heating. Also, place the label indicating "Radiant Floor Heating" on the control.

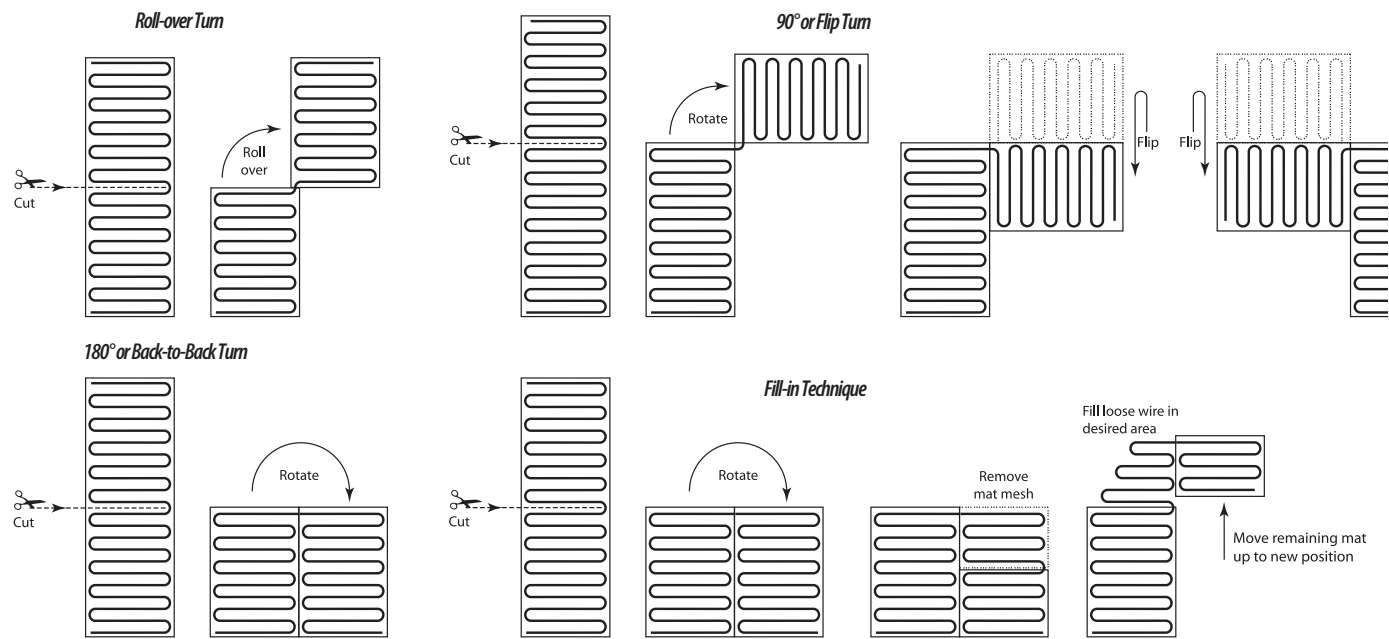
Radiant Floor Heating Mat	
<b>Warning - Risk of electric shock</b>	
CKT#	Electric wiring and heating panels contained below the floor. Do not penetrate floor with nails, screws, or similar devices
	Nappe de chauffage de sol
<b>Avertissement: Risque de choc électrique</b>	
CKT#	Câblage électrique et nappes de chauffage dans le sol. Ne pas enfoncer de clous, vis ou autres éléments d'assemblage similaires.
	Tapete radiante para calefacción de pisos
<b>Precaución: Riesgo de electrocución</b>	
CKT#	El piso contiene cables eléctricos y paneles calafactores. No insertar clavos, tornillos ni dispositivos similares.



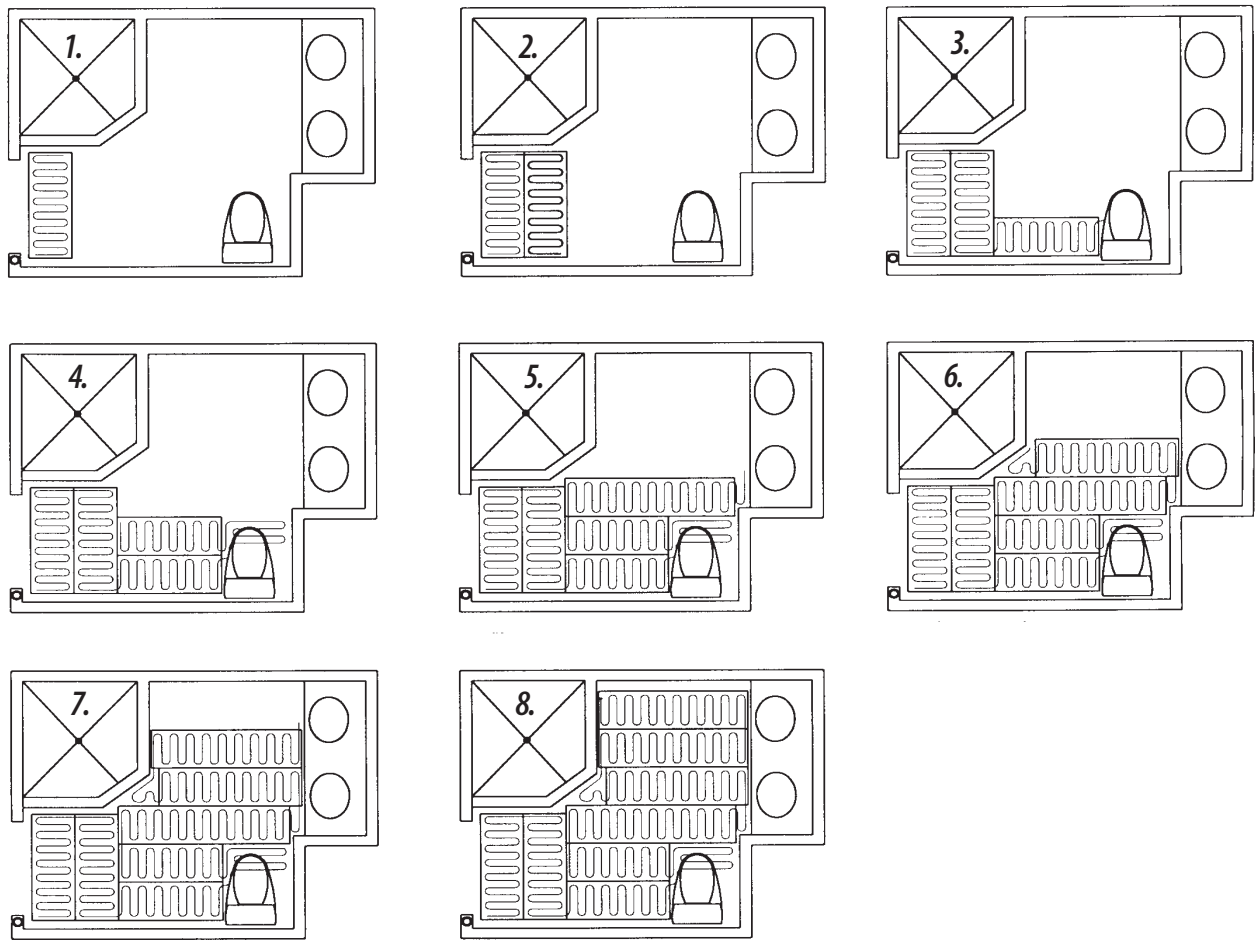
General layout of the HeatStep™ Mat installation

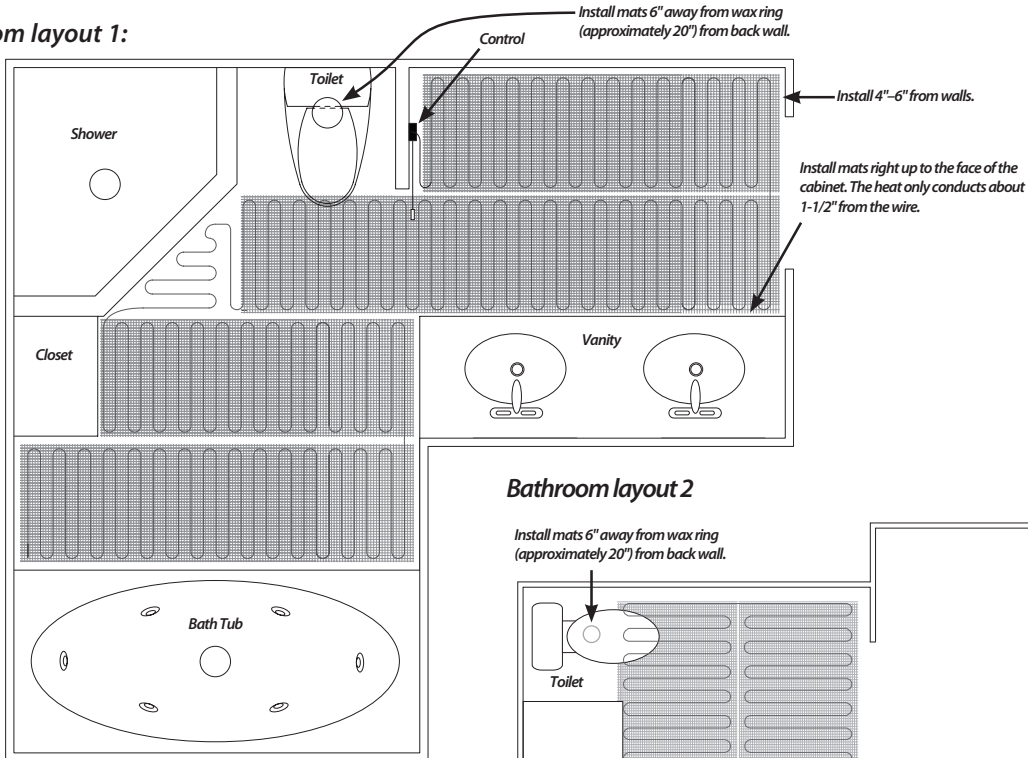
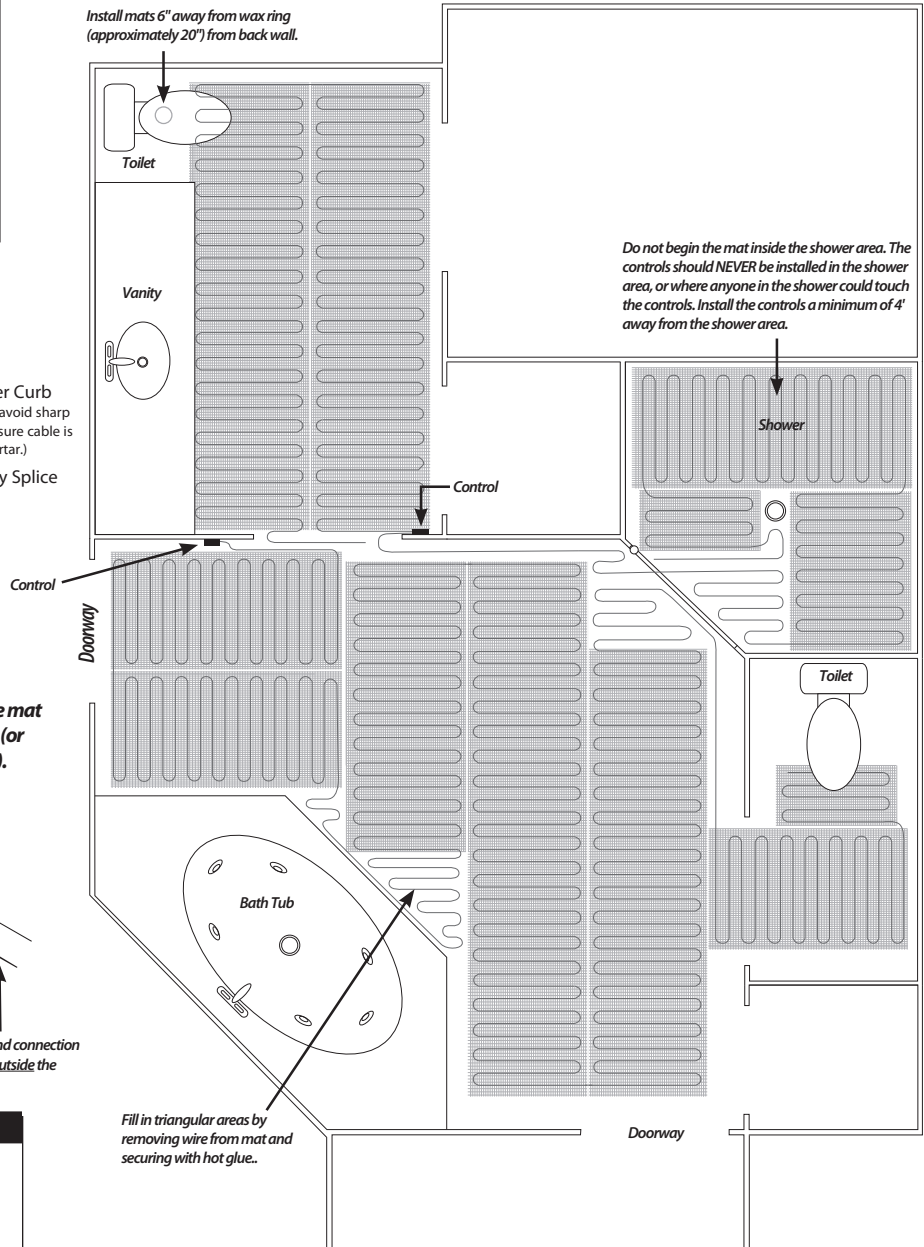
# Appendix

## Types of turns

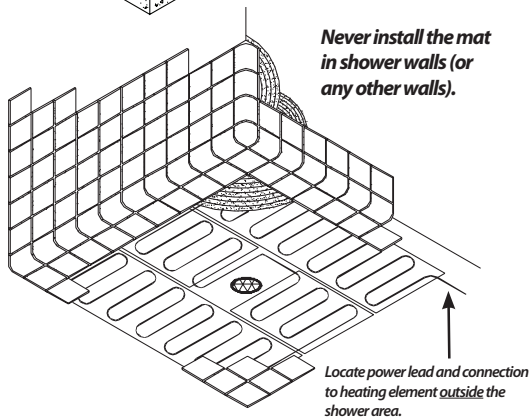
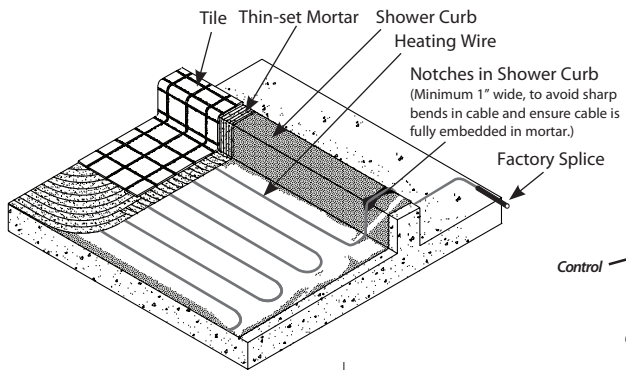


## Step-by-step layout for a typical bathroom



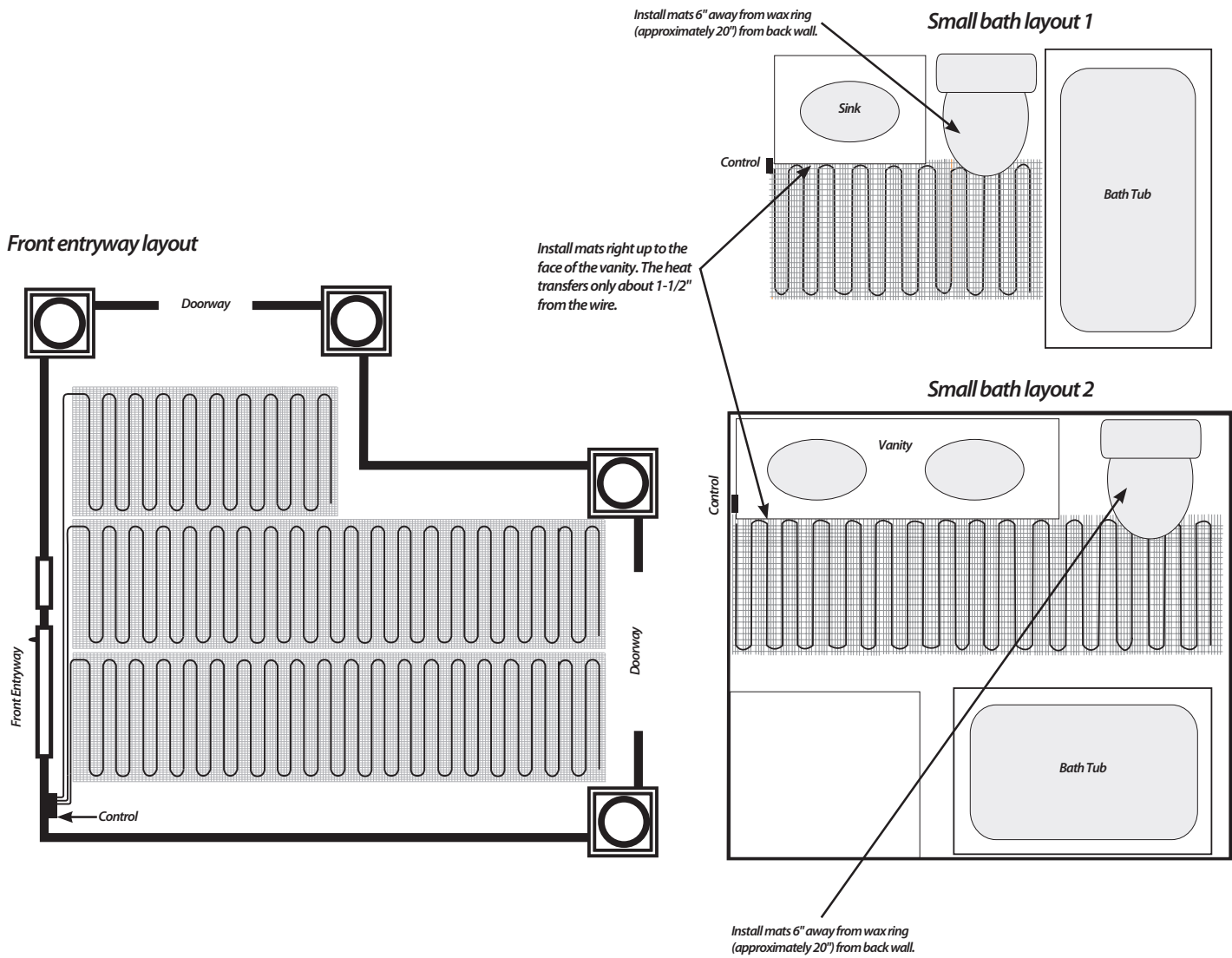
**Bathroom layout 1:****Bathroom layout 2**

Locate power lead and factory connection to heating wire at least 1' outside the shower area.

**IMPORTANT**

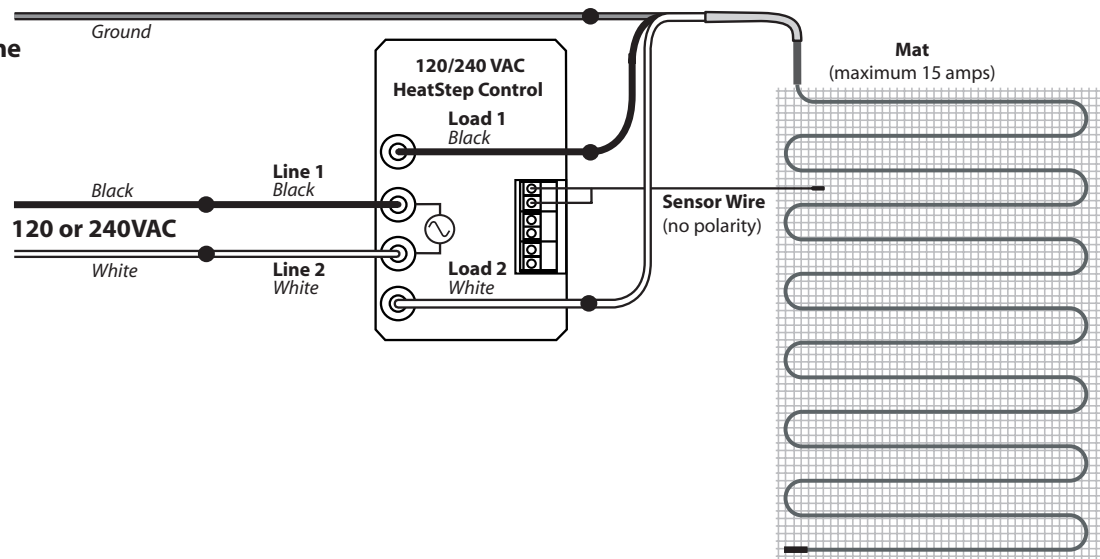
See phase 4 for complete details and Cautions. This application into a shower area must be verified by the local inspector or the authority having jurisdiction.



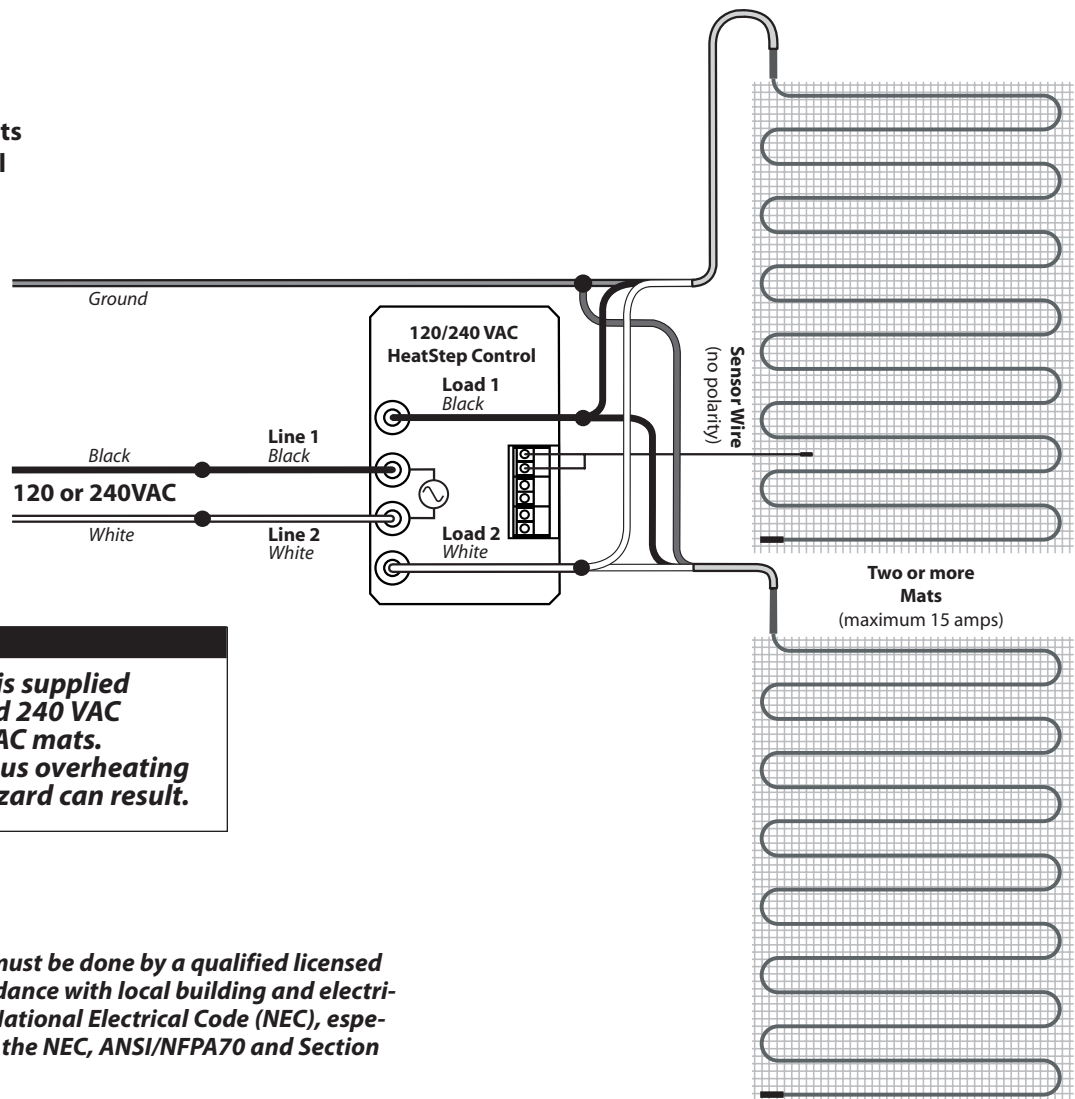


## 120/240VAC Control Wiring Diagrams

**Typical Wiring for one HeatStep™ Mat with HeatStep™ Control (120/240VAC)**  
20-amp circuit.



**Typical Wiring for multiple HeatStep™ Mats with HeatStep™ Control (120/240VAC)**  
20-amp circuit.



### ⚠ CAUTION

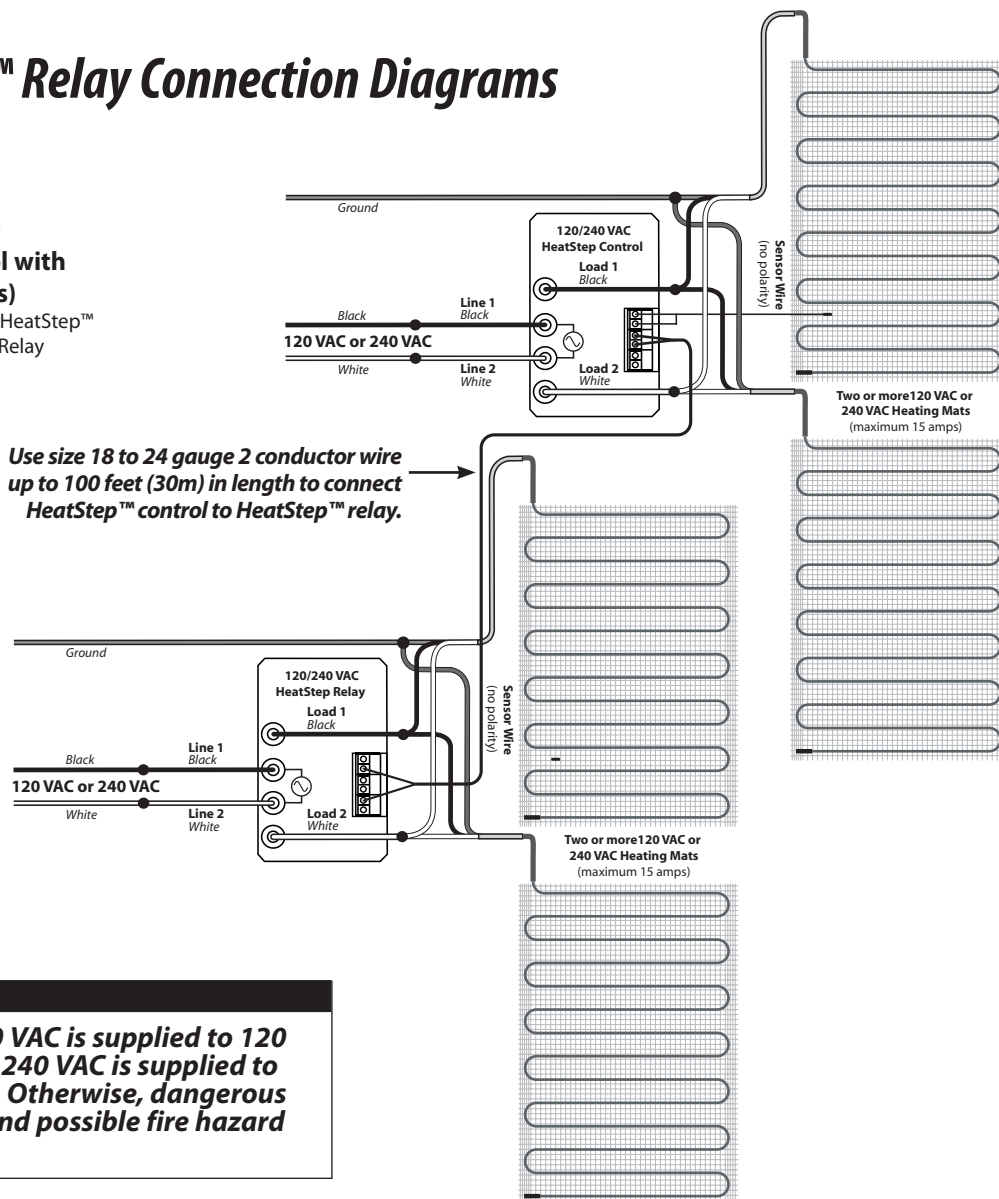
**Make sure 120 VAC is supplied to 120 VAC mats and 240 VAC is supplied to 240 VAC mats. Otherwise, dangerous overheating and possible fire hazard can result.**

**Note:** All electrical work must be done by a qualified licensed electrician in accordance with local building and electrical codes, and the National Electrical Code (NEC), especially Article 424 of the NEC, ANSI/NFPA70 and Section 62 of CEC Part 1.

## HeatStep™ Relay Connection Diagrams

### Typical Wiring for HeatStep™ control with HeatStep™ Relay(s)

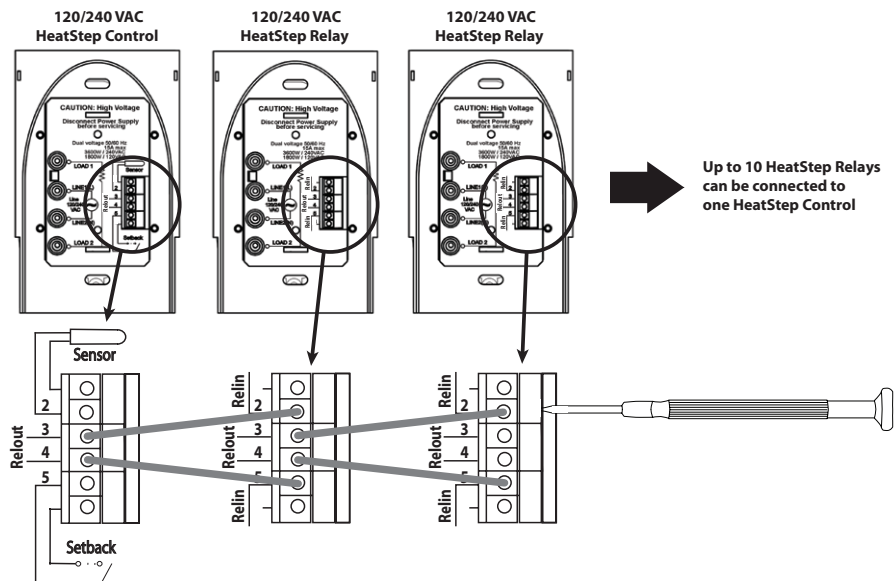
20-amp circuit for each HeatStep™ control and HeatStep™ Relay



### CAUTION

Make sure 120 VAC is supplied to 120 VAC mats and 240 VAC is supplied to 240 VAC mats. Otherwise, dangerous overheating and possible fire hazard can result.

### Diagram for connection of signal wire between HeatStep™ Control and Relays



**Note:** All electrical work must be done by a qualified licensed electrician in accordance with local building and electrical codes, and the National Electrical Code (NEC), especially Article 424 of the NEC, ANSI/NFPA70 and Section 62 of CEC Part 1.

## Connecting Multiple Mats

**NOTE:** The HeatStep™ control is not shown in these diagrams in order to simplify them. These diagrams are given only as examples of how to properly connect multiple mats. Care must be taken not to overfill a box. Be sure to use wire nuts that are the correct size for the connections being made. Follow all codes for wiring. If in doubt, consult an electrician.

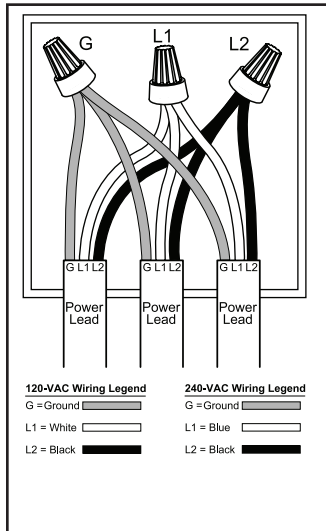


Illustration showing how to connect three mats at the thermostat control electrical box.

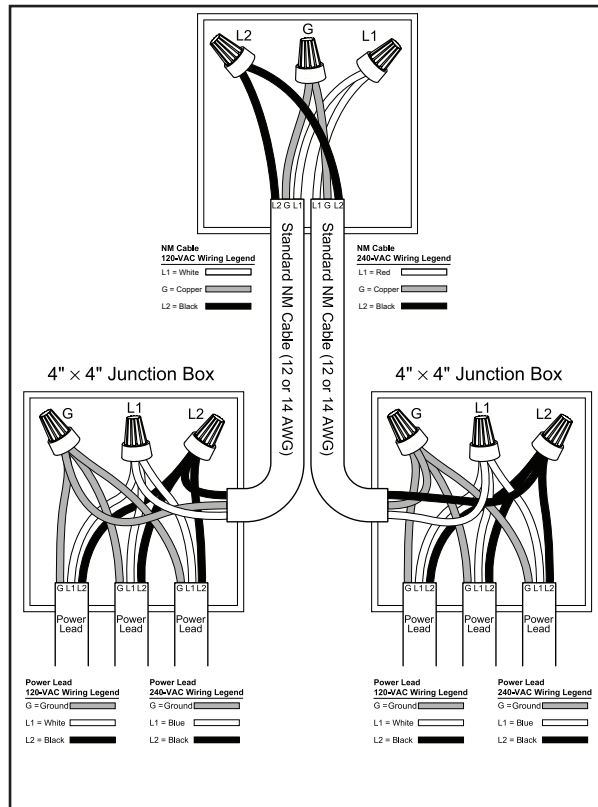
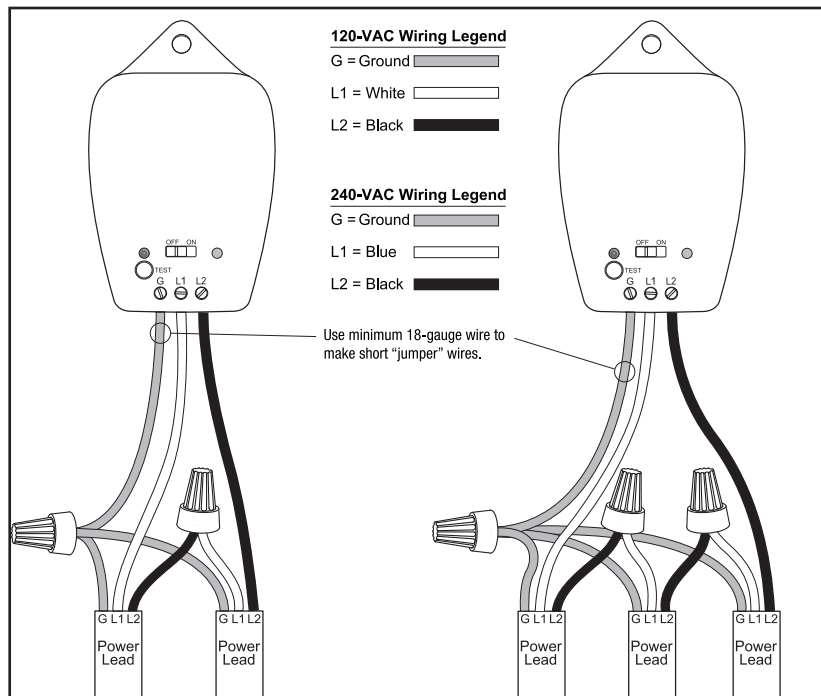


Illustration showing how to connect multiple mats from multiple junction boxes at one thermostat control electrical box.

## Connecting the Wire fault detector



Illustrations showing (left) how to connect the Wire Fault Detector to two cables, and (right) how to connect the Wire Fault Detector to three mats. The Wire Fault Detector can monitor no more than three mats simultaneously. Do NOT leave the power leads connected in "series" like this when making final wiring connections; the cables will not heat sufficiently.



## Troubleshooting Guide

If problems arise with the HeatStep™ Mat or its related electrical components, please consult this troubleshooting guide. If not qualified to perform electrical work, it is highly recommended a qualified, licensed electrician be hired.

**Any electrical troubleshooting work should be performed with the power removed from the circuit, unless otherwise noted.**

Although this troubleshooting guide is provided to assist with problems experienced with a HeatStep™ system, results are never guaranteed. Bostik does not assume any liability or responsibility for damage or injury that may occur from using this guide. If problems with the system persist, call the manufacturer.

<i>Problem</i>	<i>Possible Cause</i>	<i>Solution</i>
Mat resistance measurement is outside the range printed on the nameplate label.	An analog meter (using a moving needle) was used to take the reading.	Obtain a digital multi-meter and re-measure the resistance.
	If measurement shows an open or short circuit, the Heating Wire has been damaged.	Record resistance between all wires and contact the manufacturer.
	If measurement is just a little low or high, room temperature has affected the resistance.	Make the room temperature 75°–85°F (24°–30°C), or contact the manufacturer.
	The resistance measurement could be from more than one mat wired in series, or wired in parallel. Either will provide false resistance readings.	Make sure resistance measurements are for only one mat at a time.
	The multi-meter may be set to the wrong scale.	The multi-meter should typically be set to the 200 ohms (200Ω) scale. For mats with resistance range higher than 200 ohms on the nameplate label, set the meter to the 2000 ohm (2kΩ) scale.
Floor is not getting warm.	Mat has been damaged.	Measure mat resistance. Check for both “open circuit” and “short circuit” as detailed earlier in this manual. If damaged, record resistances between all wires and contact the manufacturer.
	GFCI has tripped, indicated by a light or “GFCI TRIP” on the control.	Check for loose wire connections. Reset the GFCI on the control or circuit breaker. If it trips again, check for a short circuit in the mat as detailed earlier in this manual. If mat is damaged, record resistance between all wires and contact the manufacturer. If mat is not damaged, replace the GFCI control. Also see “GFCI conflicts” below.
	Incorrect voltage supplied, or mismatched electrical components used.	Measure “line” voltage, then measure “load” voltage. 120 VAC mats have black and white power leads. 240 VAC mats have black and blue power leads.
	Uninsulated concrete slab floor.	Surface temperatures rise slowly an uninsulated slab and heat is lost to the ground below.. If, after 5 to 8 hours of heating, the floor is not warmer to the touch, check for mat damage (see “Mat has been damaged” above). A clamp-on ampmeter may be used to verify the amps are correct to each mat.
	Mats are wired in “series” or “daisy chained” (end-to-end).	Multiple mats must be connected in “parallel” (or black-to-black, white-to-white).
Floor heats continuously.	Incorrect wiring. The control was “bypassed” when it was wired to the power supply.	Make sure wiring connections are correct. Consult the wiring diagram on the back of the control the instructions that came with the control, or the wiring diagram in this manual.
	Defective control.	Return control to dealer for replacement.
Control is not working correctly.	If a programmable control, the programming may be incorrect.	Carefully read and follow control programming instructions.
	Incorrect voltage supplied, or mismatched components used.	Test voltage, verify parts. See “Incorrect voltage supplied” above.
	Floor sensor is not wired properly, or is not working properly.	Make sure only one floor sensor is connected to the control. Also see “Sensor is loose or broken” above.
	Loose connection(s) on line side and/or load side of control.	Remove and reinstall the wire nuts at each connection. Make sure the wire nuts are tight. Check all connections back to the breaker.
	Defective control.	Return control to dealer for replacement.
Control is not working at all.	No power is supplied.	Check circuit breaker. Measure voltage at the control. Check all connections between breaker and control.
	Defective control.	Return control to dealer for replacement.
GFCI conflicts and false-trips	An electric motor or a ballasted light source is sharing the circuit with the mat.	Electric motors and other electrical devices can cause a GFCI to false-trip. Run a dedicated circuit to the floor-warming system or select a different branch circuit..





The manufacturing facility's Quality System is an ISO 9001:2008 registered facility through LRQA.



(800) 7BOSTIK / (800) 726-7845